Microbiological Quality Assessment of Raw Milk to Identify Sources of Contamination

H.M.G.K.C. Uduwerella, D.C. Mudannayake, A.M.N.L. Abeysinghe
Uva Wellassa University, Badulla, Sri Lanka

and

C.V. Jayasinghe
Kotmale Dairy Products (Pvt), Patana, Sri Lanka

Introduction

Bogahawatta area is one of the major milk supplying area to Kotmale Dairy Products (Pvt) Ltd, Bogahawatta factory. One of the major challenges faced by Kotmale Products (Pvt) Ltd is the poor microbiological quality of the milk received at the factory. This research was carried out to find out the contribution of contamination sources for milk contamination in Bogahawatta area.

Methodology

Thirty small holder cattle farmers participated in this study. Farmers were selected using a simple random sampling method. Six samples (two milk samples and four swab samples) were collected from each farmer. Two milk samples (one sample received at the factory under chilling condition & other one received under room temperature) were received. Swab samples were collected from udders of cow, skin of cow, hands of farmer and milking bucket & lid. The time period for receiving milk from farm to the factory and temperature differences occurred during transportation period were recorded. The Total Plate Count (TPC) method was used to enumerate the total aerobic micro organisms present in the samples. Eosin Methylene Blue (EMB) Agar method and Violet Red Bile (VRB) agar method was used for enumeration of E. coli and Coliforms present in the samples, respectively. Karl Pearson Correlation Coefficient method and paired t-test was used to identify the relationship between the contamination sources and contamination of milk.

Results

The TPC counts revealed that all the factors are not significantly affecting for final milk contamination. According to r values (relationship) of samples, udders of cow is identified as the most related factor ($r = 0.322$) for the total aerobic micro organisms present in milk. It shows positive low correlation to microbial count in final contaminated milk. Microbial content in milking bucket and lid ($r = 0.261$) are identified as the second related factor for contamination of final milk while skin of cow, time duration for receiving milk and hands of farmers show negligible relationship to aerobic micro organisms present in final milk.

According to the r values (relationship) of E. coli counts it is observed that, skin of cow is the highest related factor ($r = 0.593$) for E. coli in final contaminated milk. It shows moderate positive relationship to E. coli count in final contaminated milk. Other factors were not significantly affecting final contamination of milk by E. coli. The second factor was identified as the famer's hands ($r = 0.305$). Temperature differences occurred during transportation period showed no relationship to presence of E. coli in final contaminated milk.

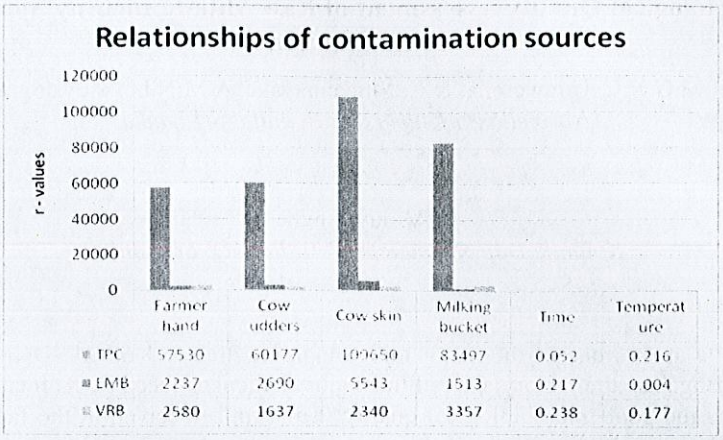

Figure 1: Relationships of contamination sources to Final contaminated milk

The Coliform counts showed that all the factors considered had no significant effect on the contamination of final milk. According to the r values (relationship) of Coliform counts, the time duration for receiving milk (r = 0.238) was identified as the factor most related for Coliform development in final milk. It shows positive low correlation to microbial count in final contaminated milk. Temperature difference occurred during transportation period was the second related factor (r = 0.177) while the microbial content in hands of farmer showed no relationship to Coliform presence in final contaminated milk.

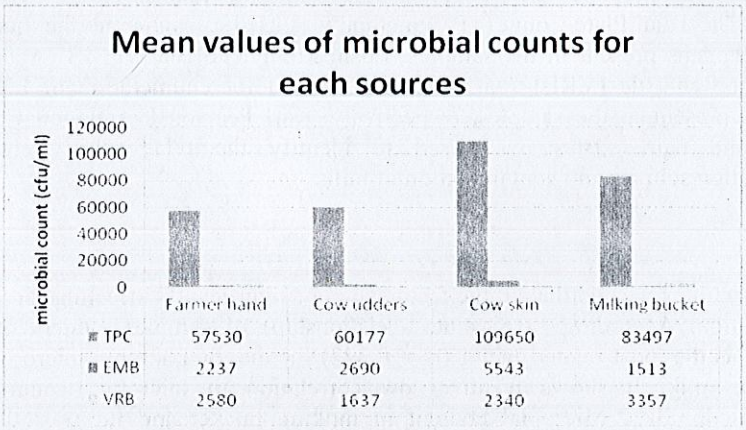

Figure 2: Mean values of microbial counts for contamination sources

According to the numerical values of total aerobic micro organisms present in samples, skin of cow is identified as the highest contributing source (109650 cfu/mL) for the total aerobic micro organisms present in milk. Microbial content in milking bucket & lid (83497 cfu/mL) are identified as the second significant factor contributing for contamination of final milk. According to the numerical values of E. coli counts it is seen that, skin of cow is the highest contributor (5543 cfu/mL) for E. coli in final contaminated milk. The second factor was identified as the udders of cow (2690 cfu/mL). The Coliform counts numerically showed that milking bucket and lid is the

highest contributor (3357 cfu/mL) for E. coli in final contaminated milk. The second factor was identified as the hands of farmer (2580 cfu/mL).

According to the numerical values of total aerobic micro organisms and E. coli developed during transportation, highest micro organisms' development shown as 30 minutes taken for delivering milk to the factory (total aerobic micro organisms - 298600 cfu/ml, E. coli- 29400 cfu/mL). Coliform development shows the highest growth (20400 cfu/ml) in 10 minutes delivery time.

According to the numerical values of total aerobic micro organisms developed during transportation, highest total aerobic micro organisms (298600 cfu/mL) development is shown as 3.9 C0 temperature differences occurred at the delivery. For the highest E. coli growth (29400 cfu/mL) it shows at 3.7 C0 temperature differences. Coliform development shows the highest growth (20400 cfu/mL) at 5.6 C0 temperature differences.

Discussion

According to the results, it shows that presence of E. coli in cow skin significantly affect for E. coli count in final milk. It happened due to farmers' practices at milking time. E. coli is indicator for fecal contamination. Before milking they only clean the cow udders not the full body of cow. So the fecal matter can be contaminated to milk.

All other factors are not significantly affecting for the micro organisms development in milk.

According to the numerical values of each micro organisms present, improper cleaning of udders of cow causes the development of total anaerobic micro organisms present in milk. Micro organisms in cow udder can easily contaminate the milk during the milking time. The numbers of coliforms in milk have increased with the time for receiving milk to the factory. The temperature difference during transportation period also highly affect for coliform development. This can be due to the poor transportation facilities.

Conclusions

According to the results factors affecting for total plate count in final milk can be orderly listed as microbial content in udders of cow, microbial content in milking bucket & lid and temperature differences incurred during transportation period. For E. coli growth factors can be listed as microbial content in skin of cow, microbial content in hands of famer, microbial content in udders of cow, time duration for receiving milk, microbial content in milking bucket and lid. For Coliform growth, factors are listed as time duration for receiving milk, temperature differences occurred during transportation period, microbial content in udders of cow, microbial content in milking bucket and lid abd microbial content in skin of cow.

References

Bramley, A. J. and C. H. McKinnon 1990. The microbiology of raw milk. Dairy Microbiology, Ed. R. K. Robinson. Elsevier Applied Science Publishers, London, 1:163-208.

Jay, J. M. 1927. Modern Food Microbiology. Aspen poblishers, Inc. Gaithersburg, Maryland, 35-53

Kurweil, R. and M. Busse 1973. Total count and microflora of freshly drawn milk. Milchwissenschaft, 28:427.

Acknowledgment

Our respectful acknowledgment goes to all the academic staff members in Department of Animal Science, Faculty of Animal Science and Export Agriculture, Uva Wellassa University, who helped me to achieve research target successfully.

Our thanks are also due to all the workers in Kotmale Dairy Products (Pvt), Patana, who gave great supervision for us to conduct my research successfully.